



## **NASA STTR 2004 Phase I Solicitation**

### **T2.02 Advanced Concepts for Flight Research**

**Lead Center: AFRC**

This Topic is intended to be broad, and to solicit and promote technologies for the following:

- Automated online health management and data analysis
- 21st Century air-traffic management with Remotely Operated Aircraft (ROA) within the National Air Space,
- Modeling, identification, simulation, and control of aerospace vehicles in-flight test, 4/ flight sensors, sensor arrays and airborne instruments for flight research, and 5/ advanced aerospace flight concepts.

Proposals in any of these areas will be considered.

Online health monitoring is a critical technology for improving transportation safety. Safe, affordable, and more efficient operation of aerospace vehicles requires advances in online health monitoring of vehicle subsystems and information monitoring from many sources over local and wide area networks. Online health monitoring is a general concept involving signal-processing algorithms designed to support decisions related to safety, maintenance, or operating procedures. The concept of online emphasizes algorithms that minimize the time between data acquisition and decision-making.

The challenges in Air Traffic Management (ATM) are to create the next generation system and to develop the optimal plan for transitioning to the future system. This system should be one that seamlessly supports the operation of ROAs. This can only be achieved by developing ATM concepts characterized by increased automation and distributed responsibilities. It requires a new look at the way airspace is managed and the automation of some controller functions, thereby intensifying the need for a careful integration of machine and human performance. As these new automated and distributed systems are developed, security issues need to be addressed as early in the design phase as possible.

Safer and more efficient design of advanced aerospace vehicles requires advancement in current predictive design and analysis tools. The goal is to develop more efficient software tools for predicting and understanding the response of an airframe under the simultaneous influence of structural dynamics, thermal dynamics, steady and unsteady aerodynamics, and the control system. The benefit of this effort will ultimately be an increased

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understanding of the complex interactions between the vehicle dynamical subsystems with an emphasis towards flight test validation methods for control-oriented applications. Proposals for novel multidisciplinary nonlinear dynamic systems modeling, identification, and simulation for control objectives are encouraged. Control objectives include feasible and realistic boundary layer and laminar flow control, aeroelastic maneuver performance and load control (including smart actuation and active aerostructural concepts), autonomous health monitoring for stability and performance, and drag minimization for high efficiency and range performance. Methodologies should pertain to any of a variety of types of vehicles ranging from low-speed high-altitude long-endurance to hypersonic and access-to-space aerospace vehicles.

Real-time measurement techniques are needed to acquire aerodynamic, structural, control, and propulsion system performance characteristics in-flight and to safely expand the flight envelope of aerospace vehicles. The scope of this topic is the development of sensors, sensor systems, sensor arrays or instrumentation systems for improving the state-of-the-art in aircraft ground or flight-testing. This includes the development of sensors to enhance aircraft safety by determining atmospheric conditions. The goals are to improve the effectiveness of flight testing by simplifying and minimizing sensor installation, measuring new parameters, improving the quality of measurements, minimizing the disturbance to the measured parameter from the sensor presence, deriving new information from conventional techniques, or combining sensor suites with embedded processing to add value to output information. This topic solicits proposals for improving airborne sensors and sensor-instrumentation systems in all flight regimes—particularly transonic and hypersonic. These sensors and systems are required to have fast response, low volume, minimal intrusion, and high accuracy and reliability.

This topic further solicits innovative flight test experiments that demonstrate breakthrough vehicle or system concepts, technologies, and operations in the real flight environment. The emphasis of this topic is the feasibility, development, and maturation of advanced flight research experiments that demonstrate advanced or revolutionary methodologies, technologies, and concepts. It seeks advanced flight techniques, operations, and experiments that promise significant leaps in vehicle performance, operation, safety, cost, and capability; and require a demonstration in an actual flight environment to fully characterize or validate.